

Kingdom at a fare and a quarter on surrender of the usual voucher issued to members. From stations in England and Scotland such tickets will be available from September 8 to 22, in Ireland from September 8 to 28.

The local railway companies will issue return tickets at single fares to members during the meeting for short journeys, and the Belfast Street Tramways Company has kindly offered to issue passes to members for its cars free of charge. These cars pass the College gates. The accommodation for visitors has increased considerably since the last meeting in Belfast, two large and several smaller hotels having been established since then, and it is expected that a large amount of private hospitality will be offered by the citizens. J. BROWN.

THE COLLEGES OF THE UNIVERSITY OF LONDON.

IN considering the educational needs of London it is important to remember that its extended area, its large population, and its exceptional municipal government all conspire to place the metropolis in a category by itself. Local authorities and other organisations which may serve to meet the requirements of the rest of England are not suitable for the unique wants of the greatest city in the world. When framing the Education Bill now before Parliament, the Government recognised this exceptional character, and very wisely postponed for a future occasion the consideration of the coordination of existing institutions of different educational grades in London, and of the addition of necessary schools and colleges. Similarly, the University of London, as reconstituted by the Commissioners appointed under the Act of 1898, is an institution of a unique character. No other university has a similar constitution, because nowhere, at home or abroad, are the conditions of the metropolitan area duplicated.

As was pointed out in an article in *NATURE* in 1899 (No. 1548, vol. lx.), if, as is done in the University of London Act, 1898, the area to be served by the London University is that included within a radius of thirty miles from the University buildings, it will be found that the University has, on a very moderate estimate, to meet the higher educational needs of about seven million inhabitants. It was shown in the article referred to that to accomplish this huge undertaking with any hope of success it would be necessary to make the fullest possible use of every existing institution which could be regarded as of university standing.

It is instructive in this connection to compare the provision of university education in some other districts with that to be found in the capital. The population of Scotland is under four millions and a half, yet there are, north of the Tweed, four largely endowed and well-equipped universities, and in addition a university college. The total population of the eight large towns in England provided with university colleges is under three millions and a half; while Wales, with a population of under two millions, has three university colleges. So that, even on the grounds that London should be made as well off as the other parts of Great Britain, it may be urged, fairly and temperately, that there is need for a great and immediate advance.

For these reasons amongst others we are glad to find that University College is making an earnest appeal for largely increased funds in aid of higher education and the facilities for research in London. If the teaching University of London is to be built up on existing institutions, it is of the highest importance that University College should be incorporated with it. A short time ago a joint committee of the council of the College and the senate of the University considered the subject of incorporation, and though they have not finished their deliberations, they have agreed on certain points, viz. :—

(1) For incorporation to take place the College must be free from debt.

(2) The University will not take over University College School. Accommodation must therefore be provided on a new site.

(3) The University will require extensive rearrangements of the Medical School.

All outstanding debts are already provided for by the Drapers' Company, which has generously become responsible for them to the extent of 30,000*l.* In addition, about 60,000*l.* have been contributed, a large part of which has been given on condition that the incorporation of the College in the University is really effected. But a much larger sum is needed. To provide a site and new buildings for University College School, to refit the present school buildings and to carry out other indispensable alterations, not less than 110,000*l.* will be required. For the completion of the College buildings, thus providing adequate accommodation for both teaching and research in the many different branches of knowledge, 250,000*l.* are necessary. For departmental expenses, including the maintenance of laboratories, libraries, &c., an annual income of 6000*l.*, or a capital sum of 200,000*l.*, must be provided. For the endowment of existing unendowed chairs and for the foundation of additional professorships a yearly sum of 20,000*l.* must be forthcoming, and this represents a capital sum of 700,000*l.* In short, to perfect and complete the College and to render fruitful its incorporation in the University a sum of at least one million pounds must be found.

If our merchants and manufacturers appreciated the importance, as a factor in our national commercial success, of the higher education of the people of London, there would be no difficulty in obtaining the sum required by the council of University College. As we have chronicled from time to time, the merchant princes of America have supplied for similar institutions in the States very many times the amount asked for by University College. The Leland-Stanford University of California has received nine millions sterling from private munificence; Chicago University has been given over two and a half millions, and many other universities have similarly been provided with their necessary millions.

University College is fully justified in its appeal to the public by a splendid record of activity during the seventy-five years of its existence. The standard of the studies carried on throughout this period has been that of a university, and the yearly output of original work has not been exceeded by that of any constituent college of a British university. We cordially recommend its claims to all those who are able to be munificent, and would suggest that no more suitable way of celebrating the Coronation in London could be found than the provision of this million pounds to begin the work of establishing in the capital of the Empire a teaching university worthy of our imperial aspirations.

But, as has often been pointed out in these columns, the responsibility for the provision of educational facilities which will bring us in line with other progressive nations rests, not upon individuals, but with the State. Private benevolence is never better employed than when it is used to assist higher education and research, but it ought not to be regarded as an excuse for the neglect of a national duty; yet over and over again this is done by statesmen of both parties. Mr. Balfour occupied this position on Wednesday of last week, when speaking at the Mansion House in connection with the distribution of prizes awarded under the commercial education scheme of the London Chamber of Commerce. He acknowledged that our nation "has lagged behind all the great nations of the world, not merely in commercial education, which is a portion of technical education, but also in many of the wider and more important aspects of national education." His remarks upon the importance of studying

commerce in the spirit of impartial scientific investigation and wide knowledge were also to the point. Mr. Balfour said, in effect, that there could be no doubt about our leeway, or upon the value of broad and scientific education as the chief factor of progress, but he looked to the general community to "set itself to work to bear the great responsibilities which the needs of our country have thrown upon our shoulders."

It is only when educational provision is under consideration that our statesmen are content to leave obvious national defects to be remedied by chance munificence in the way suggested. In military and naval matters the Government is held responsible for efficiency, whatever assistance may be obtained from voluntary effort. The same principle must be applied to higher and technical education before we can hope to make our educational

tunity for the State to show it. Let a liberal grant be made from the national exchequer, and private donors would understand that the statesmen who express fine sentiments upon the value of higher education to national welfare are actually convinced of the urgent necessities of the case. It is because this example has not been set that the various colleges of the University have to carry on their work with very inadequate resources. We commend these considerations to the Duke of Devonshire, who is to speak at the Mansion House on May 9 at a meeting to be held in support of the appeal for funds for advanced secondary education and research at University College.

It must be remembered that, when looked at broadly, this question of the provision of an adequately endowed and fully equipped University of London is a much

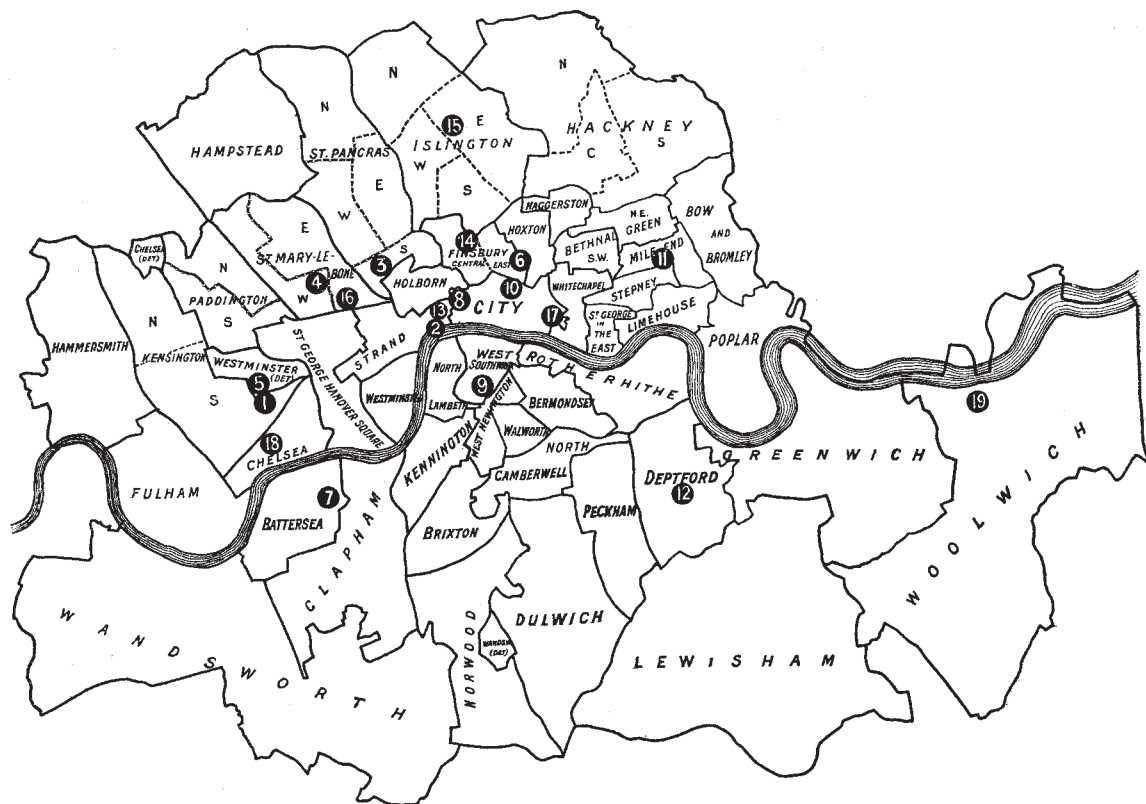


FIG. 1.—Distribution of Colleges and Polytechnics in London. The order is that given in the Report of the London Technical Education Board.

1. Royal College of Science. 2. King's College. 3. University College. 4. Bedford College. 5. Central Technical College.
6. Finsbury Technical College. 7. Battersea Polytechnic. 8. Birkbeck Institution. 9. Borough Polytechnic. 10. City of London College.
11. East London Technical College (People's Palace). 12. Goldsmiths' Institute. 13. London School of Economics and Political Science.
14. Northampton Institute. 15. Northern Polytechnic. 16. Regent Street Polytechnic. 17. Sir John Cass's Aldgate Institute.
18. South-Western Polytechnic. 19. Woolwich Polytechnic.

forces equal to those we have against us. The States which are making headway, and equipping themselves for industrial war, are those which give the greatest encouragement to the advancement of knowledge. Until our statesmen recognise this fact and act upon it, there can be no assurance against the loss of national position which must come sooner or later. The present policy of drift can only be compared with that of the man who is improvident enough to neglect to provide for old age because he hopes that some generous friend will present him with an endowment assurance.

The Government should lead the way to improving higher education, not by words, but by deeds. Practical sympathy is what is needed at present more than anything else, and the University of London offers a good oppor-

larger one than that of securing sufficient funds to make possible the incorporation of University College in the University. Even when its incorporation has been effected, University College will be but a constituent college of what we hope is destined to be a powerful and comprehensive University, binding together all those institutions located within the metropolitan area which, by a little adaptation and some necessary expansion, can legitimately claim university rank. The consummation for which every earnest educationist in London should work is the incorporation in the University of London, in the same large way that University College desires, of all suitable colleges and polytechnics. There is King's College, which in one important respect, since it has already moved its secondary school to Wimbledon, has

advanced a step further on the road to incorporation than University College. The Royal College of Science, with its intimate connection with the Board of Education and its exceptional facilities for training teachers of science, would worthily fill an important part in the work of the University. The Central Technical College of the City Guilds, subsidised by the wealthy City companies, provides higher education, and could immediately take its place in the University to teach advanced technology. Bedford College, too, which has specialised in the direction of the higher education of women, must be included.

Finally, there are the polytechnics. On more than one occasion it has been pointed out in NATURE that the amount of research work accomplished in the polytechnics of greater London rivals successfully that done in many university colleges. It must, it is true, be admitted that to be worthy of the great University which it is hoped the current decade will see thoroughly established, the polytechnics will have to curtail their work. At present they attempt the education of all comers from twelve years of age and upwards. But just as it has been made a condition of the incorporation of University College that the school in connection with it shall be moved elsewhere, so in the case of the polytechnics, the existing day schools for boys and girls, where an education on the lines of the "School of Science" curriculum of the Board of Education is given, will have to be transplanted, in order that the buildings and the equipment of the polytechnics may be entirely at the disposal of the senate of the University. Similarly, the recreative side of the general training offered by many of the polytechnics will have to be provided elsewhere, for it will scarcely be compatible with the dignity of a great university to perpetuate the present arrangements for providing students with social enjoyments. With these modifications, and perhaps some others, the polytechnics, situated as they are in all parts of the metropolitan area, as will be seen from the accompanying outline map (Fig. 1), based upon the Report of the London Technical Education Board for 1900-1901, are peculiarly well adapted to become constituent colleges.

There are immediate advantages accruing from an arrangement such as that outlined of a comprehensive university, consisting of the three university colleges, the Royal College of Science, the City Guilds Institute, the thirteen or so polytechnics, and perhaps a few other more specialised institutions, all bound together as necessary parts of one university, possessing the same aspirations, and all engaged in the same work of higher education. Such an organised whole will effect far more for London than the present individual and sporadic efforts of separate uncoordinated institutions competing the one against the other. And such an university could still preserve its former character as an imperial examining board for granting degrees.

A development of this kind and on this scale will doubtless necessitate the expenditure of many times the million pounds asked for by University College. But when the inhabitants of the wealthiest city in the world are educated to understand that no spending is so profitable as that on higher education and on the endowment of research, there will be little difficulty in obtaining the necessary funds. The immediate necessity is the provision of the amount required to ensure the incorporation of University College in the University of London; but this must be followed by a strenuous endeavour on the part of all men of science and influential men in every other department of mental activity to instruct Londoners in their duty towards their city and country of providing a permanently endowed University of London, consisting of constituent colleges situated in every part of the enormous area for the higher education of which the University is responsible.

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PROF. ALFRED CORNU.

CORNU was born in 1841 at Châteauneuf, and entered the great military school of Paris, the École Polytechnique, at the age of nineteen. After four years of study there he entered the École des Mines, which he quitted in 1866, thus completing a brilliant career as a student. One year later, at the age of twenty-six, he was chosen as professor of physics at the École Polytechnique, a post which he filled to the end of his life and adorned with the many results of his scientific researches.

It would be impossible in a brief review of Cornu's life to give more than the barest outline of his contributions to original knowledge. His position as a teacher gave him, amidst the material surroundings of his laboratory, the leisure to work. The beauty, the dignified ease and perfection of his investigations, the keen perspicacity of his observations, the masterly restraint, so to speak, of the scientific memoirs which from time to time he contributed to the scientific world, all bespeak a man of no ordinary capabilities, a master of his profession. Clear in his exposition of scientific matters, exquisitely clear alike in his experimental demonstrations and in the language in which he expounded their theory, he was as great in teaching as in research. Optics was his first love, and though he laboured successfully in other branches of experimental physics, it was to optics that he returned, and in the field of optics were achieved his greatest successes in physical investigation. The pages of the *Comptes rendus* and of the *Journal de Physique* bear eloquent testimony to the activity and penetration of his mind. Already, from 1853 to 1865, he had begun to contribute to the *Académie des Sciences* notes, the earliest of which relate to the refraction and reflection of light and to the problems of crystalline reflection. Following on the work of Jamin, he later pursued the subjects of vitreous and metallic reflection, and studied the connection between them. He showed that they were but parts of one and the same phenomenon, though affecting different regions of the spectrum, there being, as he showed, a true continuity between them.

Soon after entering upon the duties of his chair Cornu began with laborious and patient preparation those experiments upon the velocity of propagation of light which have become classical. Fizeau on the one hand, Foucault on the other, had already made determinations, each on his own lines. Foucault's value, then supposed to be the best, was 298×10^{10} in C.G.S. units. Cornu's results, of which an account will be found in some detail in NATURE of February 4, 1875, raised this figure to 3004×10^{10} , in vacuo, or 30033 , in air. His method, which was fundamentally the same as that of Fizeau, was applied to the transit of light over a distance of 46 kilometres (or between two stations 23 kilometres apart, the one at the Observatoire, the other at Montheréry); and the instrumental perfection of his rotatory apparatus enabled him to observe up to the twenty-first extinction of the beam, thus securing a precision far in advance of that attained by Fizeau. For his determination of the velocity of light he was awarded the *prix Lacaze* in 1878, the same year in which his merits were recognised by his admission to the Académie des Sciences. In 1872 he wrote papers on the theory of electrostatics, in which he expounded the potential theories of Gauss and Green, then little known in France. They are to be found in vol. i. of the *Journal de Physique*, then recently founded by his friend d'Almeida.

For several subsequent years Cornu was occupied with researches on the spectrum. He measured the wave-lengths of the hydrogen rays with a precision previously unknown, enabling a comparison to be made between the values so obtained by experiment and the theoretical formulæ which had been